SCIENCE.

FRIDAY, DECEMBER 4, 1885.

COMMENT AND CRITICISM.

STUDENTS OF MAPS may have noticed upon nearly all maps of Colorado issued during the past twenty years a settlement indicated upon White River, near the western boundary of the state, denominated Golden or Goblin City. This is a curious example of the persistence of a geographical blunder. Many years ago an army expedition traversed this region, going from Fort Bridger, Wyo., to old Fort Massachusetts, Col. In this neighborhood are bad lands, eroded into curious forms, which naturally suggest a ruined city; and the commander of the expedition gave the locality the name of *Goblin* City, which name appeared on his map. The map-makers, in their haste to fill up the blanks in this unsettled region, jumped to the conclusion that this was a veritable settlement, and gave it a place on their maps, — a place which it has ever since retained. Not only have the commercial map-makers, almost without exception, fallen into this error, but such authorities as the U. S. engineer office and general land office have adopted it. The name has, however, been gradually changed from Goblin to Goldin, and thence to Golden City, while more than one enterprising map-maker, reasoning, probably, that a city cannot exist without means of communication with other settlements, has constructed on paper a road down the White River to it. It is scarcely necessary to add that there is not, and never was, a settlement in this neighborhood.

IN THE APRIL ISSUE of the *Druggists' circular* appeared an offer by the publisher of three prizes for "the three most practical and otherwise valuable essays on disinfectants." In the May issue the following gentlemen were announced as the committee of award: Prof. S. A. Lattimore, Rochester, N.Y.; Dr. Henry B. Baker, Lansing, Mich.; Prof. Joseph P. Remington, Philadelphia. In the June number it was announced that nearly two dozen essays had been handed in, and several of them, selected at random, were printed in that and succeeding issues. Finally, in the October number, the successful names were announced: first prize, $125, to Mr. Marcus Benjamin, New York City; second prize, $75, to B. W. Palmer, M.D., Detroit, Mich.; third prize, $50, to R. G. Eccles, M.D., Brooklyn, N.Y. The essays all appear in a book issued by the *Druggists' circular*, entitled 'Disinfectants and their use.' From the editorial remarks made in the issue announcing the decision, we learn that the delay was caused by the difficulty of arriving at a unanimous decision as to the merits of the various essays, and that it was finally decided by a majority of the committee. From a letter which appeared in the *New York medical journal* of Nov. 7, we infer that Dr. Baker's was the dissenting voice. It is also distinctly stated in the announcement of the award that the decision of the committee is not to be regarded as an endorsement of the accuracy and scientific value of the essays, but is merely an indication of relative value.

The result reached by the committee has been in many quarters adversely criticised. Inasmuch as these essays were intended to meet the urgent demand for reliable disinfectants, in view of the possible advent of cholera, it is very unfortunate that they should be sent broadcast through the land, with what amounts to a statement that their accuracy and scientific value are not indorsed by the committee. Essays with these qualifications were called for, and, if they do not supply this want, they are of no more value than so many school-boy compositions: indeed, they may do infinite harm, as, this want of indorsement being overlooked, a false sense of security may be created in those who employ the remedies suggested, to the exclusion of means which have been found reliable and trustworthy. In the first six essays, there being twenty-one in all, we find no less than thirty substances mentioned as having disinfecting value; how many there are in all, we do not know. We can imagine the satisfaction which would be felt by one of those subscribers asking for "the most practical information in relation to disinfectants," for whose benefit these essays were obtained, when he turned to this volume for help.

WE HAVE RECENTLY received "Outline of matter and advance sheets of the Report of the

legislative, administrative, technical, and practical problems of irrigation, in course of preparation and publication, by William Ham Hall, state engineer, California." This outline is 304 pages in length, and is an exhibit of the character of the report in preparation, which will be in seven books, forming five or six volumes, of five hundred pages each, or from 2,500 to 3,000 pages in all. How the compilers are paid is not stated; but judging from the following sentence,—"Great public works, such as national roads, railroads, basins and docks, canals and the canalization of rivers, whether enterprises of the state, of departments, communities, or of particular companies, whether toll is to be charged in any way or not, or whether a subsidy of treasure is to be granted or not, or whether any part of the public domain is to be used or not, can only be executed by virtue of special law, which can be passed only after an administrative inquiry has demonstrated the feasibility and desirability of the work, and a report has recommended it,"— which is a fair sample of the book, we presume they are paid by the word; the idea evidently being that of quantity, and not quality. A thorough investigation of the problem of irrigation, as developed in the old world, with reference to the new, would be of almost inestimable value; but the work should be concise, stating briefly the old laws, the work done in each country, the necessity and uses of irrigation as drawn from these examples, the land to be irrigated in California, and the plan to be adopted. If the book had been written with these ends in view, it would have been generally read and widely useful. Now few will read it, for it is necessary to look for the facts in a volume of words as you would for a needle in a haymow. We trust the legislature of California will thoroughly revise the work, and see that it is made less expensive and more useful.

Although there has been within recent years a great multiplication of biological journals in Europe, many of which, from the character of the articles they have published, take high rank, yet they have nearly all been in fact, if not in name, confined almost exclusively to physiology and morphology. This is especially the case with the zoölogical periodicals, none of the best of which touch, except incidentally, upon the systematic, geographical, or biological departments of the science. In three fields there are special journals, with their *clientèle* principally among amateurs. We refer to entomology, ornithology, and conchology. There is certainly a great deal of work in zoölogy, of great value and interest, and quite outside of either morphology or physiology. It would be a great convenience if there could be a journal which included a large fraction of the work of the character indicated.

We are glad to learn that such a journal is to be inaugurated in Germany, under the title *Zoologische jahrbücher*, and the sub-title *Zeitschrift für systematik, geographie und biologie der thiere*. It is to be edited by Dr. J. W. Spengel of Bremen, and published by Fischer at Jena. It is desired to give it a distinctly international character, and it is hoped to secure the co-operation of American zoölogists. The editor justly attributes special value to thorough monographs, either of large or small groups, from any part of the animal kingdom, and to faunal papers. The division of the journal devoted to the life-histories of animals ought to prove peculiarly interesting and valuable. It is high time that something more was made of these than mere curiosities — which, in most cases, is all they pretend to be. Those who intend contributing will be pleased to know that articles will be published in German, French, English, or Latin; and that the authors are furnished with forty reprints of them, besides being paid a small sum. That the new journal will be of a high character, the editor's name assures us. Dr. Spengel is one of the best-known and ablest of the younger German zoölogists. His memoirs on the urogenital system, and on Bonellia viridis, are of altogether exceptional value, and are familiar to all scientific morphologists.

THE MODE OF ADMISSION INTO THE ROYAL SOCIETY.[1]

Our contemporary *Science*, in the last number which has reached this country, makes some remarks concerning the admission of candidates into the Royal society, against which, in the interests of truth and accuracy, it is our duty to protest, the more especially as it is also implied that the French system of canvassing those who are already fellows of the society is also adopted.

The statements actually made are, 1°, that there is an "actual competitive examination, on the result of which a certain number of successful candidates are annually chosen:" and, 2°, "that the English method has the additional disadvantage

[1] From *Nature* of Nov. 19.

that it does not secure the men whom it is most desirable to honor." We read also, "During the school-boy period the distinction between different individuals is a distinction of learning, and an examination is not unfitted to discover the boy who deserves reward. But learning is not the quality which a state needs to make it great. Casaubons are not the kind of men who have built up English science. The qualities which ought to be encouraged, and which it should be a nation's delight to honor, are qualities too subtle to be detected by a competitive examination."

For the benefit of our transatlantic brethren, we may as well state the facts as we know them. For reasons into which we need not enter here, as they do not affect the question at issue, nearly forty years ago the Royal society determined to limit the yearly admissions to fifteen; and to throw upon the council the responsibility of selecting the fifteen who are to be nominated for election, a general meeting of the society reserving to itself the right of confirming or rejecting such nomination. It may be instructive to remark that for thirty years that right has not been exercised.

The way in which the matter is worked is as follows: The friends of a man, who are already in the society, and who think he is entitled to the coveted distinction, prepare a statement of his services to science, in many cases without consulting him in any way. This paper, thus prepared, is sent round to other fellows of the society, who are acquainted with the work of the candidate, and who sign it as a testimony that they think he is worthy of election. In this way, when the proper time arrives, some fifty or sixty papers are sent in to the council for their consideration. In the council itself we may assume that the selection of the fifteen is made as carefully as possible, in view not merely of individual claims, but of the due representation of the different branches of science. It is not for us to state the safeguards or mode of procedure adopted, but we think we may say that the slightest action or appeal to any member by the candidate himself would be absolutely fatal to his election. Finally, we may say that, years back, when a heavy entrance-fee had to be paid, there were cases in which the question had to be put to one whose friends were anxious to see him elected, whether he would accept election. The small yearly subscription of £3, now the only sum payable, makes even this question unnecessary at the present time.

[How does it happen that our English contemporary makes no allusion whatever to Professor Chrystal's address to the British association, which, as printed in *Nature*, gave rise to all our animadversions? — ED.]

HISTORY OF ANGLO-SAXON.

PROFESSOR WUELKER, although literary executor of Grein, and editor of the new 'Bibliothek,' has nevertheless found time to prepare a most useful book for all students of English literature and English philology. Ten Brink's excellent history was purely literary; something of the same kind, though less able, was Earle's 'Anglo-Saxon literature,' published last year. Quite otherwise with Wülker: he furnishes a supplement, not a rival, to Ten Brink's book, paying little attention to actual contents, but giving the fullest account of the new literature which has grown up by way of comment on the old. Ten Brink gave us a description: Wülker gives us a guide-book, — a much-needed help for the student, and a basis for all new work. Wülker's tone is judicial and dignified; his decisions are as impartial as one could expect; while the enormous labor involved in sifting so many dust-heaps — dissertations, programmes, etc. — cannot be praised too highly: for, though it is true that for one man who is able to write literature there are a thousand who can judge and classify facts, it is equally true that the thousand are sure to scorn facts, and rush into original work.

The first section of the book contains an account of Anglo-Saxon philology in different countries. From the first steps under Elizabeth and Archbishop Parker, from the worthies who thought that Anglo-Saxon was the speech of Adam in Paradise, the growth of this study, at first under legal and theological shelter, is carefully traced to our own time. Wülker's criticism of the earliest efforts is properly indulgent; otherwise with modern failures, as where Loth's 'Grammar' (1870) is neatly despatched with the remark, "What is right in the book is old, and what is new is wrong." We have pleasant glimpses of a woman, Elizabeth Elstob, editing and translating Aelfric's 'Homilies,' having audience of Queen Anne in the interests of Anglo-Saxon, and afterwards (1745) publishing the first Anglo-Saxon grammar written in English. A century later Miss Gurney makes the first English translation of the 'Chronicle.' For American scholarship Wülker has encouraging words, and remarks that Anglo-Saxon is much more studied here than in England.

The second section gives a list of all books which aid in the study of Anglo-Saxon philology and literature; and here one feels afresh the enormous preponderance of German scholarship. Aside from living scholars, what would our philology be

Grundriss zur geschichte der angelsächsischen litteratur, mit einer übersicht der angelsächsischen sprachwissenschaft. Von Dr. RICHARD WUELKER, ord. professor an der Universität Leipzig. Leipzig, *Veit & Co.*, 1885.

without the labors of Grimm, of Grein, and of Koch? Wülker's lists seem here and there somewhat meagre. Under 'Metrik' (p. 108) we miss Schmeller's 'Ueber den versbau der allitirierenden poesie' (München, 1839), although this is mainly concerned with Old Saxon; and Lanier's 'Science of English verse' (New York, 1880), which sets forth at length a theory of Anglo-Saxon versification. That the theory is untenable does not matter; for Wülker includes in his various lists quite worthless books (cf. p. 175). Further, we fail to find mention of Ellis's 'Early English pronunciation,' in which pp. 510–537 treat the pronunciation of Anglo-Saxon.

The third section, which takes up four-fifths of the book, considers Anglo-Saxon literature, and whatever has been written about it. The arrangement is arbitrary, 'Cædmon' and Cynewulf taking precedence of the heathen poetry. As regards the famous hymn in Northumbrian dialect written at the end of the Cambridge manuscript of Beda (*Hist. eccl. gent. Angl.*), Wülker recedes from his sceptical position of eight years ago, and joins Zupitza and Ten Brink in believing this text to be Cædmon's own, or at least to have passed as such so early as the eighth century. Wülker admits the personality of Cædmon, but accepts as his work nothing save the hymn; whereas Ten Brink was inclined to credit Cædmon with a part of the 'Genesis.' Cynewulf is treated at length. While the 'Phœnix' is assigned to him, and the end of 'Guthlac,' Wülker brings forward fresh arguments against the Northumbrian origin of the poet, and discourages the tendency to ascribe poems to Cynewulf on no better basis than general resemblance to his undoubted works. Proceeding to the smaller and lyrical pieces, Wülker concludes with Leo that 'The ruin' refers, not to a castle, but to the city of Bath.

For the heroic and heathen poetry, we find, besides much other matter, sixty pages of well-sifted information about 'Beowulf.' Wülker thinks the original heroic poetry was in the shape of ballads; and he decides for the theory that 'Beowulf' was composed about the middle of the seventh century, by a poet-monk, on the basis of these old songs. The summary is very thorough; but Garnett's translation is wrongly stated to be in prose; on p. 268, Ten Brink ought to be named as agreeing with Müllenhoff in regard to the mythology in 'Beowulf;' and Wülker might have added, as usual, his own decision. So rich a display of poetic talent brings the author to the question whether there are any dramatic elements in Anglo-Saxon literature. We have always regarded Ward's denial of any such elements (*Hist. Eng. dram. lit.*, vol. i. p. 6) as an ungrounded statement. Wülker more justly shows that not only in the 'Seafarer,' but also in 'Christ,' there is a strong dramatic element; while, on the other hand, he proves that these elements were never developed, and never came to a regular representation.

At last we reach Anglo-Saxon prose. With regard to Aelfred, Wülker puts the 'Cura pastoralis' first among the royal translations, the 'Boethius' and the 'Soliloquies' last; while he leaves undecided the authorship of the 'Metra.' With Aelfric, and the review of various prose fragments in theological and quasi-scientific fields, the book comes to an end. An index is added which might be much more exhaustive. Several names are omitted; e.g., Professor Johnson, whose work is mentioned with praise (pp. 438–440). Some misprints occur here and there, and a few harmless mistakes, such as *Siebenzeiligen* (p. 308) for *Siebenfüssigen*.

Wülker's book leaves one full of respect for the author's patience, accuracy, and diligence. We may and do disagree with some of his conclusions; but that matters little, since the opposite conclusion, and the arguments for it, are carefully given. Another impression is a renewed sense of the small part played by Englishmen and Americans in the study of their own tongue. One cannot resist the conviction that we in America should do well to abandon in part the mediaeval discussions which so often fill our teachers' 'institutes' and conventions, and to encourage the modern and scientific spirit which devotes its energies to the patient investigation of facts. The field is open: an immense amount of work is to be done before the history of our literature can be written. Let teachers of English in academies and schools throw themselves into the actual study of the language rather than into discussions about system and method, — discussions sometimes useful, but often mere rhetoric, theorizing, and waste of time for all concerned.

GEOGRAPHICAL NOTES.

Heinrich Entz and August Mer have recently independently studied the voyage of Hanno, the Carthaginian. Both agree that its termination was at the Island of Fernando Po, in the Bight of Biafra, called by Hanno the Isle of Gorillas. The colony of Thymaterion is identified by them, as by most authors, with the town of Mazaghan, and the promontory of Soloé with Cape Cantin. The river Lixus is regarded by Mer as the Senegal for weighty reasons, though Entz and others have favored the Wadi Draa, much farther north.

Hanno's Island of Cerné was probably Goree, and his Western Horn (or bay) was the Bight of

Benin. Much weight attaches to the opinion of M. Mer, who is a retired naval officer of forty years' experience, including three years of cruising between the equator and Gibraltar on the west coast of Africa.

The journey of Messrs. Capello and Ivens in central Africa during the past two years was beset with exceptional hardships. The explorers proceeded from the limits of the Portuguese territory in the direction of Cubango, as far as the lower part of the Mucussu, where they found themselves in a barren region intersected by water-courses and marshes, which obliged them to turn northward through an unknown region infested with tsetse, and affording little food. Sixteen of their party died from tsetse-bites, without counting cattle and hunting-dogs. After travelling 4200 geographical miles, they reached Feté almost exhausted, having lost sixty-two men during the fifteen months. The explorers reached Lisbon on the 17th of September, where they were received by the king, and welcomed by an enthusiastic demonstration of their countrymen.

Paulitschke has studied the relations of the western branches of the Somali, and the north-eastern tribes of the Gallas, near the Gulf of Aden. His results, with a good map showing their distribution and the route of the author and his companion, Hardegger, are to be found in the September number of the Proceedings of the Geographical society of Vienna.

The Bulletin of the Italian geographical society for September contains extracts from the unpublished journals of Pellegrino Matteucci, the African traveller. These have been edited by Dalla Vedova, and are illustrated by a map showing the itinerary and also the routes of Nachtigal and Rohlfs. Matteucci's journey, one of the most remarkable on record, extending from the Red Sea at Suakin to Lake Chad, and thence to the Niger and the sea, has hardly attracted the attention it deserves; chiefly, perhaps, on account of the early death of this promising and brilliant explorer.

The third part of the Isvestia of the Russian geographical society, for 1885, recently received, contains an important map by General Tillo, showing the lines of equal horizontal and total intensity of terrestrial magnetism in European Russia for the epoch 1880. It is accompanied by two smaller charts for the middle of the nineteenth century, showing the secular variation of the same elements. The same number contains an abstract of the report of the work done by the topographical corps of the general staff during 1884, the important details of which have been already noticed in *Science*.

ASTRONOMICAL NOTES.

Occultations of α Tauri. — The occultations of this bright star and of a few of the other naked-eye stars of the Hyades will be visible again over a considerable portion of this country on the night of Dec. 19; but as the phenomena occur well on toward morning, they are not likely to be extensively observed. A most favorable opportunity, however, will occur on the night of 1886, Feb. 12, when a larger number of the stars will be occulted, and most of them early in the evening. Our observatories are so widely scattered that prediction for one place is of very little use for another (so rapidly does the parallax of the moon vary with hour-angle and zenith-distance), and each intending observer must predict them for himself with the data given in the *American ephemeris*. These recurring occultations of so many of the bright stars of the Hyades, which will continue for several years, afford pretty fair opportunities for a good determination of the semi-diameter of the moon, especially if the fainter stars (to the 8 mag.) can be filled in on a chart, and their occultations be predicted and observed at the dark limb of the moon. They also offer, to those who have the means of determining accurately their local time, but have never made a telegraphic determination of their longitude, the next best method of determining this, if they are willing to go through the somewhat tedious reduction of the observed occultations.

The shower of Biela meteors. — The earth received a visit, on the night of Nov. 27, from a part of the ghost of the lost comet of Biela, in the shape of a widely observed meteor-shower, a repetition of that of 1872, Nov. 27, and no doubt both of them parts of the meteor-stream which was once Biela's comet. It will be remembered that this comet separated into two during perihelion passage in 1845–46, came round in 1852 as two comets 1.5 million miles apart, with most extraordinary alternate fluctuations in brightness, and has been wholly invisible as a comet since then. But at its descending node, which the earth passes about Nov. 27, the comet's orbit closely approaches that of the earth, and an extraordinary meteor-shower from a radiant in Andromeda on 1872, Nov. 27, in which some single observers counted them at the rate of 4,000 or 5,000 per hour, has always been attributed to a meteor-stream into which Biela's comet is resolving itself. The present shower, so far as reports are at hand, does not seem to have equalled that of 1872, but it was a very decided one. At Georgetown, D.C., two of Professor Hall's sons and Mrs. Hall (the latter watching only a short time) counted 213 meteors between $6^h\ 30^m$ and $7^h\ 50^m$. Angelo Hall, who

makes the report, describes them as generally small, from 4° to 10° in length, with occasional bright ones with short trains. At the same place, Mr. D. Horigan, one of the naval observatory watchmen, who had had considerable experience in meteor-observing, gathered a party of four to watch in the four quadrants, and their combined count gave —

Number from	7^h	0^m	to	7^h	30^m,	100
"	"	7 30	"	7	55 ,	100
"	"	7 55	"	8	38 ,	100
"	"	8 38	"	9	0 ,	28

At 9 o'clock it became hazy and clouded over. Mr. Horigan describes them as occasionally as bright as the 3d mag., with short trains; color, white or violet; but most of them faint, and some scarcely visible. He fixes the radiant near γ Andromedae. From Syracuse, N.Y., are reported a shower at 7^h, in which 120 were counted, and another about 9^h, furnishing a count of 130, with no statement as to clearness of sky. Professor Pickering telegraphs from the Harvard college observatory, "Great shower, radiant, χ Andromedae, observed at Geneva last night." The telegram is dated Nov. 28, and no doubt refers to Geneva, Switzerland. χ Andromedae is very near γ. Newspaper telegrams also report brilliant showers at Elizabeth, N.J., at Teheran (Persia), and at Naples and London. It is evident that this meteor-stream, with a period of about $6\frac{2}{3}$ years round the sun, is going to furnish an exceedingly favorable opportunity for studying the dispersion and distribution of comet material along its orbit.

NOTES AND NEWS.

During the past year the council of the New England meteorological society has engaged in the following branches of work: 1°. The securing of a corps of reliable observers of meteorological phenomena, with special attention to precipitation and temperature; 2°. The publication of the monthly bulletin; 3.° The dissemination of the daily indications of the U. S. signal service, and the local display of weather flags; 4°. The special investigation of thunder-storms. The work of securing reliable observations was so far advanced in November, 1884, as to warrant the issue of the first bulletin for that month, and its regular publication thereafter. The first bulletin contained reports from forty-five observers; that for September, 1885, from one hundred and twenty-three observers. As a result of the society's efforts, local weather flags are daily displayed in more than one hundred cities and towns of New England. The special investigation of thunder-storms was made under the supervision of the secretary. More than four hundred observers co-operated, the largest number of reports for any single storm having been two hundred and three. The preliminary study of the reports thus far made indicates that some interesting results have been obtained, which will be reported upon subsequently. The original membership of the society was 9; the number at the close of the year, 95. The expenses of the society have been kept within its income, but this has been done through the generous co-operation of friends who have from time to time contributed liberally to its resources. In looking forward to the work of another year, the council suggests that special efforts be made to add to the membership of the society, as well as to the list of observers. It must be remembered that the financial prosperity of the society depends on the number of members. It is desired to include in the membership all who are interested in meteorological studies in New England, whether they make observations or not. A member need not be an observer, nor is it required that an observer shall be a member.

— The preliminary circular proposing the formation of a State academy of science in Indiana, issued by authority of the Brookville society of natural history, has elicited such a general response in favor of the movement, that the same society has issued a circular calling a meeting of all the people of Indiana interested, to be held at Indianapolis on December 29. In order that an understanding may be had of the present state of scientific study in Indiana, the following persons have kindly consented to present papers upon the several subjects mentioned: Richard Owen, M.D., Sketch of the work accomplished for natural and physical science in Indiana; David S. Jordan, M.D., Ichthyology; Prof. John M. Coulter, Botany; Prof. J. P. Naylor, Physics; R. T. Brown, M.D., Geology; Prof. O. P. Jenkins, Lower invertebrates; E. R. Quick, Mammalogy; Prof. Robert B. Warder, Chemistry; Prof. O. P. Hay, Herpetology; Daniel Kirkwood, LL.D., Astronomy; P. S. Baker, M.D., Entomology; Maurice Thompson, Mineralogy; Rev. D. R. Moore, Conchology; Sergeant Orin Parker, Meteorology; J. B. Connor, Statistics; A. W. Butler, Ornithology.

— In the general English and American magazines for November there are very few articles of scientific interest. The *Century* contains another illustrated paper on 'Typical dogs,' the various breeds of setters being this month the topic of discussion. There is a short account, by as many different authors, of the history and characteristics of the Gordon setter, the American setter, the Irish setter, the Llewellyn setter, and the modern English setter. Perhaps this article would be

more entertaining to a 'sporting man' than to one of scientific pursuits. In the *Contemporary review* there is a very interesting article, by Sir John Lubbock, on 'Some habits of ants, bees, and wasps,' in which the author tries to show that the instincts of flight in a 'bee line,' of cell-making, and of storing food for the young, really lie within very narrow lines, and are not inconsistent with the theory of natural selection. Some observations on the instinct and longevity of ants are added. There is an anonymous article on 'Fish out of water' in the *Cornhill magazine*, which is not worth reading, and another in the *Leisure hour*, by Mr. A. H. Molam, on 'Cornish coughs,' which is but little better. In this connection may perhaps be noticed a very readable paper by Ernest Ingersoll, in *Lippincott's magazine*, on 'The Peabody museum of archeology,' giving concisely the history and aims of this institution, with some account of the collections.

— The next meeting of the Society of naturalists of the eastern United States will be held on Tuesday and Wednesday, Dec. 29 and 30, at Boston. The executive committee has voted to recommend that the name of the society be changed to the American society of naturalists.

— At the last teacher's institute, held in Humboldt county, Cal., the Humboldt society of natural history was organized. Prof. J. B. Brown, principal of the schools at Eureka, was elected president, and Prof. Carl C. Marshall of Arcata, secretary. The secretary would be pleased to learn of names of works in various departments of natural history that are specially adapted to that region.

WASHINGTON LETTER.

THE museum of hygiene, in connection with the office of the surgeon-general of the navy, is not so generally or widely known as is the army medical museum. It has undertaken some investigations, however, which, if brought to a successful issue, will be of great value to the general public, and will not fail to bring it into a deserved prominence. The interest of a naval surgeon in hygienic matters arises primarily, no doubt, out of the fact that he has to do with the health conditions of men necessarily crowded into a small space. Whatever may have been the origin of this hygienic museum, it will be everywhere admitted that much can be accomplished by it if its management be wise and liberal. An important step has been announced by the surgeon-general in the statement that a complete system of iron and lead pipes, with fixtures, is being erected on the outside of the museum building for the purpose of making an exhaustive series of experiments, covering all disputed points in reference to trap siphonage and the utility of the mechanism of water-closets, traps, water-basins, baths, sinks, etc. Observing stations have been established at each of the three stories, and the investigation is to include microscopical and chemical tests of the action of sewer air and different waters on pipes and tanks. When completed, the results are to be at the service of the public.

In connection with this it is interesting to note a few statements contained in the report of the health officer of the district. The year ending June 30, 1885, shows a slightly increased mortality, this increase having occurred 'in classes of disease not dependent on hygiene.' The most notable feature is the marked difference in the rates of mortality among the white and the colored population, the latter being, as everybody knows, relatively larger than in most large cities. Among white people the rate has not, during the past decade, reached as high a figure as 20, while among the colored people it has been more than 40, and never less than 30. The mean rate for ten years is, for the whites, 19.02; and for colored people, 34.99; and on the whole population, 24.38.

An item of interest relative to both the above, is the existence in the city of a training-school for nurses. It was established in 1877 by members of the medical society, assisted by benevolent people of the city. At present its students number about thirty, and it is stated that thus far no men have applied for admission. Fourteen have been graduated, of whom ten are now in practice. Lectures are given twice a week by members of the medical profession. These are free to the nurses, and persons who do not intend to enter the profession are admitted on the payment of a small fee.

Readers of *Science* are aware of the fact that a little more than a year ago the director of the geological survey determined to undertake actively the study of seismology in this country. A conference of those most interested in the work, including representatives from the signal service and the naval observatory, was held, which resulted in an agreement upon certain plans for the investigation. Another meeting of this conference was held a few days ago, those present being Captain Dutton and Mr. Hayden of the geological survey, Professors Rockwood of Princeton, Davis of Cambridge, Paul of the naval observatory, and Marvin and Mendenhall of the signal service. It was generally agreed that the most important and decided advance in the study of seismic phenomena was to be reached through a tolerably close distribution of seismoscopes, with sufficiently accurate clocks, over certain areas which have proved to be

most subject to disturbances from earthquakes. It was thought that this could best be done by the selection and appointment of local directors, each having general charge of the work in a limited area, and through whom persons at once qualified and willing to undertake the care of an instrumental equipment could be best reached. In addition it was thought desirable to organize a large corps of observers, working through the same local directors, who would report observations made without the aid of any special instruments, the system resembling somewhat that for the collection of information regarding thunder-storms, tornadoes, etc., now in use in the signal office and in the New England meteorological society. The questions addressed to such correspondents by the Swiss earthquake commission were discussed, as were also those used by Professor Rockwood in his studies of American seismology during the past fifteen years. The subject of the charting of earthquakes and the graphical representation of results of observation was considered, and a good deal of time was given to the examination of instruments, including one of the seismoscopes of the form recently described in *Science*, and some parts of a seismograph or seismometer now being constructed. Professor Davis reported upon the progress of the work of bibliography which he had undertaken a year ago, showing that much work had been done, and that the result might be ready for publication in the near future. Much confidence was expressed by members of the conference in the success of efforts being made by the geological survey to organize a systematic study of seismology.

The status of the coast survey remains unchanged up to date, although the air is by no means devoid of rumors as to the probable disposition of this, one of the oldest and one of the most efficient of the government scientific bureaus. One of these is that, to some extent at least, its work is to be divided up and transferred to other government services, and it need hardly be said that some anxiety for its future is felt by those who understand and appreciate its past.

The announcement of the resignation of General Eaton as commissioner of education was heard with regret by his many friends here. It is understood that he is to become the president of Marietta college, at Marietta, O. Z.

Washington, D.C., Nov. 30.

ST. PETERSBURG LETTER.

ON Nov. 8 the St. Petersburg society of naturalists held its first general meeting of the present winter season. A. N. Krasnow made a communication on the flora of the Kalmuck steppe (on the left bank of the Volga), which he had visited this summer with the well-known geologist, Professor Muschketow. In vol. xvi. of the Proceedings of the society the most lengthy and important paper is that on dunes by Sokolow, a young geologist, who first studied them near Sestroretzk, on the Gulf of Finland, and became then so interested in the matter that he visited dunes of the interior in the governments of Kiev and Astrakhan. He made interesting observations of the force of the wind, as indicated by an anemometer placed but twelve centimetres above the ground, and compared these with the size, shape, etc., of the sand particles moved by the wind. Observations of that kind, if systematically conducted, may be very useful to travellers in permitting them to estimate the strength of the wind by the size of the objects moved. There is also in this volume a paper on the birds of the White Sea coast, by Nikolskij. The poverty of the tundra (treeless region) of the continent is contrasted with the rich bird-life of the seacoasts and islands. Here two regions are distinguished,— that of the colder waters of the White Sea, and of the ocean east of the Swiatoi Noss, rich in individuals, but not in species; and that on the west to the frontier of Norway, in waters warmed by the Gulf Stream, where the species also are more numerous.

The geographical society has had one interesting meeting of its section of mathematical and physical geography, in which Abich lectured on his explorations of the Caucasus, his life-work. The celebrated geologist has already, for more than five years, retired from active work in the field, and lives in Vienna, occupied by the working-out and publishing of the immense material collected in the Caucasus.

No. 4 of the Isvestia of the society, issued a few days ago, is nearly entirely occupied by the preliminary report of N. D. Jurgens on the Lena polar station, and the publication of the detailed results of the meteorological observations of the first year, — Sept. 1, 1882, to August, 1883. The daily means of the principal meteorological elements are given, as also the hourly means for every month. The mean monthly temperatures have already been noticed in *Science*. As to the extremes, their relative steadiness is to be mentioned. The greatest difference between them is 29°.8 C. (in December). It is below 24° in January, March, and April, below 20° in November, and below 15° in July and August. If the limited range in summer is common to all polar stations, the same is not true in winter, when it is larger, both in North America and in the interior of Russia, but especially farther to the east, on the coast of East Siberia (Nischnekolymsk, Pitlekaj). The freezing-point

was not reached from October to April inclusive. The daily range is small, as was to be expected, on account of high latitude, position on the sea-coast, and great cloudiness of the warmer weather. The greatest difference of the warmest and coldest hour is 6°.4, in April. The small amount of cloud in winter, and the large amount in the warmer weather, are to be noted. The latter is in great measure due to fog or low clouds. The mean temperature at a depth of 0.4 metre in the ground was much higher in the yearly mean than the mean temperature of the air (—11°.6 against —17°.4). It is interesting to see, thus, how even the small covering of snow mentioned by the observers acts in protecting the ground from the frosts. The relative humidity is great in all months, as was to be expected.

	Extremes of temperature.		Mean pressure.[1]	Amount of cloud.	Prevailing wind.[2]	Mean velocity of wind.[3]
	Min.	Max.				
September	—12.3	11.0	753.9	9.0	W 26	6.7
October	—29.6	—2.5	759.3	7.2	E 25	6.5
November	—36.3	—18.3	758.9	6.0	S 23	5.6
December	—49.2	—19.4	761.7	5.1	S 23	5.3
January	—47.8	—25.9	761.5	3.7	S 28	4.3
February	—53.2	—27.1	764.9	2.6	S 30	5.0
March	—41.6	—18.6	763.9	3.3	S E 24	4.7
April	—32.8	—10.2	765.8	5.2	E 33	5.6
May	—24.2	3.3	755.6	8.6	E 29	6.9
June	—12.6	12.5	752.3	8.4	E 32	6.8
July	—0.2	12.1	757.8	7.6	E 37	8.9
August	—1.2	12.8	756.4	8.5	E 30	7.0
Year	—53.2	12.8	759.3	6.3	.....	6 1

[1] Barometer 4.9 metres above level of river.

[2] The figures show the percentage of the wind to the total number of observations (eight directions).

[3] In metres per second.

A preliminary map, based on the surveys of the expedition, accompanies the report, and gives new and important data, including the northern limit of forest. Generally it reaches to 71° north, but on both banks of the Lena to nearly 72°. The protection afforded by the high ground on the banks of the river is evidently the reason of this; the cold winds of summer, and small amount of sunshine, being the principal enemies of vegetation here, not the winter frosts, which are much more severe in the valleys of the interior, where forest-trees grow well.

At the Moscow university there was, a short time ago, a celebration of the thirty-five years' professorship of N. J. Davydow, one of the most distinguished mathematicians of Russia, his principal works being in theoretical mechanics and the theory of probabilities. Among scientific work going on there, we may mention that published recently by Professor Joukowsky, on the movements of a solid with compartments filled by incompressible liquids.

The Russian universities give their degrees of 'magister' and 'doctor' after a public disputation sustained by the recipient. The latter was recently conferred on I. S. Nasimow, for his dissertation 'On the application of the theory of elliptic functions to the theory of numbers,'—a distinguished work, say the specialists.

At St. Petersburg there was in October a brilliant 'disputation,' after which the doctor degree of chemistry was conferred on Professor Koisowalow, for his work on 'Contact phenomena.' The hero of the day was Professor Mendelejef, one of the official opponents, who made a brilliant speech of more than an hour. On Nov. 15 the degree of magister of astronomy was conferred on Prince Dolgorowsky for his work on 'The secular irregularities in the movement of the moon,' of which our astronomers have a high opinion.

O. E.

St. Petersburg, Nov. 15.

LONDON LETTER.

A DEPLORABLE accident has put an end to the career of one of the most active and useful scientific workers of our day, and has made a gap in scientific circles which will not readily be filled. On the night between Nov. 9 and 10, Dr. W. B. Carpenter, F.R.S., the eminent physiologist, was taking a hot-air bath to relieve rheumatic pains (from which he had more or less constantly suffered since his visit to America in 1882), when by some means the spirit-lamp was upset, and he was so fearfully burned that he died in four hours, in presence of his wife and his two eldest sons. There is good reason to hope that, after the first few minutes of agony, he did not suffer; his last words being, "I have had a good night, I should like to be left alone." The surgeon stated at the inquest that he "had never known so severe a case of burning, it was literally from head to foot." The funeral took place at Highgate, a hill in a northern suburb of London, on Nov. 13. Among those who assembled at the cemetery, notwithstanding the unfavorable weather, were Professor Huxley, the president, and Dr. Michael Foster, the secretary, of the Royal society; Mr. Percy Sladen, secretary of the Linnean society; Professor Judd, representing the Geological society; Professor Stewart, the president of the Microscopic society; Prof. H. N. Moseley of Oxford, representing the officers of the Challenger expedition; Prof. W. H. Flower, of the British museum; Mr. Lecky; Rev. Page Roberts, a well-known representative of the 'Broad church;' Sir Joseph Hooker

of Kew; the Rev. Dr. James Martineau; Dr. Drummond; Professor Upton; Mr. R. Potter; Mr. Talford Ely, secretary of University college; and others well known in scientific circles. In the mortuary chapel, as well as at the grave, the service was read by the Rev. Dr. Sadler, whose ministrations at the Hampstead Unitarian chapel Dr. Carpenter had attended more than forty years. A large number of strangers were present.

During the week frequent notices of Dr. Carpenter's life and work have appeared in the English journals. Born at Exeter in October, 1813, he was the son of Lant Carpenter, a Unitarian minister, and brother of Philip Carpenter, who died at Montreal in 1877, and of Mary Carpenter, the philanthropist, who died at Bristol in the same year. Though probably best known to the world as a biologist, by his books on physiology and on the microscope, his mind was pre-eminently many-sided. As much a man of letters as a man of science, there are proofs enough that, if he were the deftest of compilers, he was also the keenest of 'researchers.' The philosophical character of his mind led him to bestow much thought on higher speculations which might appear insufficiently supported for scientific use; but on these subjects he cherished especially the maxims of Schiller, that the scientific man loves truth better than his system. His services to the cause of scientific education were of the greatest value. For many years one of the first of living teachers, he applied his great knowledge and power of organization to the elaboration of the scheme of degrees in science in the University of London, of which he was registrar for twenty-two years. To the last he remained a member of its senate, and exercised a powerful and most beneficial influence on its deliberations. He leaves to his five sons the heritage of a stainless life, and of a name which, in every land where science is cultivated, will never be mentioned otherwise than with respect.

The balloting list of the officers and council of the Royal society has just been issued, and contains the following nominations: president, Prof. G. G. Stokes; treasurer, John Evans; secretaries, Prof. Michael Foster and the Lord Rayleigh; foreign secretary, Prof. A. W. Williamson; other members of council, R. B. Clifton, J. Dewar, W. H. Flower, A. Geikie, Sir J. D. Hooker, T. H. Huxley, Admiral Sir A. C. Key, J. N. Lockyer, H. N. Moseley, B. Price, C. Pritchard, W. J. Russell, J. S. B. Sanderson, A. Schuster, Lieut.-Gen. R. Strachey, and Gen. J. T. Walker. It will be seen, therefore, that it is proposed to elect as president Professor Stokes, who for many years has been one of the secretaries, and to put in the post thus vacated Lord Rayleigh, who has recently resigned his chair of physics at Cambridge. According to the statutes, of the twenty-one names proposed on the balloting list, eleven must be those of members of the existing council, and ten must be those of fellows not members of that council. The annual meeting is always held on Nov. 30.

November is usually the month of greatest fog in London, and the present year has seen no exception. Of the density of a London fog, few Americans have any idea, except, perhaps, such as live in Pittsburgh, the only place where the present writer, who has travelled much in the United States and Canada, has seen any thing approaching to the smoke-cloud which hangs over our English towns. An entire absence of wind, an atmosphere almost super-saturated with moisture, and the smoke from innumerable household chimneys where bituminous coal is burnt, are the three concurrent causes of town-fog. It was calculated a year or two ago, by Professor Percy and Prof. Chandler Roberts (chemist to the metallurgist of the mint), that the amount of solid unburnt fuel which hung in a pall over London (the population of which is, roughly, 4,000,000) amounted to no less than fifty tons. As the late Sir William Siemens pointed out, the true remedy for this state of things is the increased use of gas for fuel.

The various societies are now on the point of commencing their winter meetings. The programme for the next or 132d session of the Society of arts has just been issued. The chairman of its council, Sir F. Abel, will deliver the opening address on Nov. 18, and the following titles of papers to be read give a fair idea of the scope of the society's operations: Apparatus for the automatic extinction of fires; Load-lines of ships; Technical art teaching; Treatment of sewage; Calculating machines; Domestic electric lighting. There are three sections: 1°. Foreign and colonial; 2°. Applied chemistry and physics; 3°. Indian, — each of which holds a monthly meeting. Six courses of lectures under the Cantor bequest will also be given.

The Institute of chemistry held its anniversary meeting on Nov. 6, the eighth since its incorporation, but the first since it has obtained a royal charter. The aim of the institute is to raise the standard of knowledge possessed by professional chemists by the examination of candidates for the associateship (as a preliminary to fellowship) of the institute, and also to raise the dignity of the profession in the public estimation. The president is Professor Odling, F.R.S., of the University of Oxford. W.

London, Nov. 14.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Newcomb's 'Political economy.'

IN reviewing my 'Political economy' in the last number of *Science*, Prof. E. J. James makes some pertinent remarks about workers in one field trespassing in another. But his method of dealing with such a trespasser is one to be condemned by all lovers of good morals in criticism. It consists, in brief, in misrepresenting his teachings, and putting into his mouth language which he never used, and doctrines and opinions which he never sustained. His misrepresentations are so flagrant, that I feel it necessary to expose them immediately in the journal in which they appeared.

He represents me as undertaking "to bring order into the reigning confusion," and "to give the subject a recognized place among the sciences by being the first to treat and develop it as a science;" putting this pretentious language in quotation-marks in such a way as to make his readers believe that I used it. I used no such language, and made no such pretensions. The first-quoted phrase is, so far as I can determine, entirely of Professor James's fabrication. In the second quotation he has taken a sentence about the possible future development of economics, and altered it so as to change it into a ridiculous claim made by me for my work. What I wrote was, "The author takes a more hopeful view of the future development of economics than that commonly found in current discussion. He holds that nothing is needed to give the subject a recognized place among the sciences, except to treat and develop it as a science."

It will be seen that Professor James takes the sentence from its connection, and interpolates several words in such a way as wholly to change its meaning and application. I shall not trust myself to characterize this proceeding.

The review tends to strengthen the modest hope, expressed in the preface, that the principles laid down would be accepted as forming a well-ascertained, even if limited, body of doctrine. He does not join issue on a single principle of those referred to, but reverses, perverts, or misapplies my views on nearly every principle which he discusses.

I never asserted that "the individual, in following out his own interest, *as he views it*, will, at the same time, *always* promote *in the most efficient manner* the public interest." On the contrary, Book v., § 5, is devoted to showing the error of such a proposition. I have italicized the words in which the misrepresentation consists. Strike out the italicized words, and substitute *as a general rule* for *always*, and we shall have a different proposition, which I sustain.

"But he is trying to get formulas for a general political economy which shall hold good of present, past, and future societies alike," is an atrocious misrepresentation. The proposition in question is one which my book distinctly combats. Section 25 is wholly devoted to showing its error; and, lest the student should forget, he is again warned against it in the summary at the end of the book (p. 539).

He takes a sentence in which I show one of the compensations for the apparent evils of private ownership of land, and comments on it as if it were my main proposition in dealing with the subject. The statement that I confuse the labor party with the socialists is perhaps pardonable as being an impression which a hasty and superficial reader might readily receive, from the fact that, owing to want of space, only certain general ideas common to both could be considered. In fine, there is one, and only one, point in which he correctly reproduces the spirit of my teaching, and joins issue with it; and that is, my conclusion about the practicability of socialistic ideas in the present state of society. This subject, however, is not included in that portion of the book which I hoped would meet with universal acceptance.

I wish it clearly understood that I take no exception to the terms in which Professor James characterizes my work. That my ideas are those of a past generation, and my expressions like a voice from the dead; that I am unacquainted with the recent literature of the subject, and ignorant of actual facts in the social organism, — are views which I not only recognize his right to hold and express, but in the expression of which I admire his frankness. At the same time I do not disguise the fact that it would be very interesting to me to know whether Professor James and his school dissent from any of the principles which I lay down as forming the basis of economic science.

S. NEWCOMB.

Whatever may be thought of the general tenor of Professor James's review of Newcomb's 'Political economy,' there are one or two points in it which simply demand correction. In particular, there is a passage in the first paragraph of the review, the injustice of which can only be set right by citing it in full, and along with it the passage in Professor Newcomb's preface of which it professes to be a quotation. Professor James says, —

"Certain it is, at any rate, that if a man who had given the best years of his life to the study of political economy should wander over into the field of astronomy and physics, and undertake 'to bring order into the reigning confusion,' and 'to give the subject a recognized place among the sciences *by being the first* to treat and develop it as a science,' Professor Newcomb would be just the man to administer a severe and deserved castigation."

The paragraph in Professor Newcomb's preface upon which this charge of outrageous pretension is based is the following: —

"The author takes a more hopeful view of the future development of economics than that commonly found in current discussion. He holds that nothing is needed to give the subject a recognized place among the sciences, except to treat and develop it as a science. Of course, this can be done only by men trained in the work of scientific research, and at the same time conscious of the psychological basis on which economic doctrine must rest. To such investigators a most interesting and hopeful field of research is opened in the study of the laws growing out of the societary circulation. If the same amount and kind of research which have been applied to the development of the laws of electricity were applied to this subject, there is every reason to suppose that it would either settle many questions now in dispute, or would at least show how they were to be settled."

Of course, no one would charge Professor James with purposely inserting the words we have italicized, and thus completely altering the meaning of his quotation; but no one can read the paragraph in

Newcomb's preface without seeing the gross and unpardonable carelessness of a reviewer who would interpret it as Professor James did, not to speak of the additional carelessness in writing which led him to so misquote Newcomb's words as to make them explicitly convey the meaning he had falsely assigned to them.

Somewhat more pardonable — if due to ignorance on Professor James's part — is his speaking of Professor Newcomb as 'wandering over into the economic field' at an advanced period in his life. Most people in this country who are interested in economics know that Professor Newcomb has been a student and writer upon economics for the last twenty-five years or more. If Professor James knew this, — however low might be his opinion of the result of Professor Newcomb's studies, — his speaking of Newcomb's 'wandering over into the economic field' is simply inexcusable misrepresentation.

Professor James goes on to say that "there is no evidence in the style of reasoning in this work that the author is at all acquainted with the recent literature of the science either in England or on the continent. One great advance in economic science in the last twenty five years lies in a change of its prevailing method." I, for my part, do not know to what extent Professor Newcomb may be acquainted with the writings of the recent German economists or their English-speaking followers; but, so far as the absence of any effect of their work upon his method of discussion is relied upon as evidence on this head, it is very pertinent to ask Professor James how much of the influence of these writers is discernible in Professor Sidgwick's recent work on political economy. Professor Sidgwick, being unfortunately 'professor in moral and political philosophy,' may be regarded by Professor James as not quite enough a specialist to be cited; but we have his own word for it (in his preface) that, "among foreign writers," he had "derived most assistance from the works of Professors A. Held and Wagner;" and in spite of his having seen the new light, his book professes to be in the main a guarded restatement of the principles of the old masters.

This is not the place to enter into a general discussion of the merits of the new economists who think they have 'exploded' every principle of political economy from which they can show that an erroneous practical conclusion has been drawn, and who freely distribute such adjectives as 'crude,' 'dogmatic,' and 'mazy,' in speaking of any theory which they find has not taken note of every disturbing influence. But it is presumptuous in a member of this school to regard a general adherence to the methods of Mill and Cairnes as evidence of ignorance or incompetence.

It would take too long to show how unfair is Professor James's presentation of Newcomb's treatment of *laissez-faire*. I trust that the correction I made at the beginning of this letter may be enough to render the reader somewhat suspicious of Professor James's fairness and accuracy in representing his author. It may, however, be worth while to re-enforce this suspicion by observing that the last sentence in Professor James's article is entirely and absurdly gratuitous, as Professor Newcomb, in speaking (p. 153) of the government's assuming (an unfortunately chosen expression, I admit) that "the values of equal weights of the two metals have a certain fixed ratio to each other," is simply engaged in *describing* what governments do when they establish an unlimited bimetallic system; his discussion of the 'views' both of monometallists and of bimetallists being reserved for a subsequent portion of the book (which Professor James would seem not to have read) in which he criticises the arguments on both sides without deciding in favor of either.

FABIAN FRANKLIN.

Baltimore, Nov. 27.

The Biela meteors.

The Bielid meteors were observed here in considerable numbers last evening. I am sorry to say, that, having been very busily occupied all day, I had quite forgotten that they were expected, and so was not on the lookout for them at the beginning of the darkness. I suppose that in consequence I probably missed the maximum of the shower, which seems to have occurred very early in the evening.

On going out of my house at 7.15, my attention was immediately attracted by seeing two meteors in the sky together, followed almost instantly by others. While walking the first hundred yards, I saw twelve; and during the whole ten minutes' walk to the Halsted observatory, I counted thirty-six; though the eye was much disturbed by the street-lights, and though for a considerable part of the way the view of the sky was more or less obstructed by trees and buildings. The shower was apparently on the wane, however, and the number per minute diminished pretty regularly. Up to 7.45, about one hundred had been recorded in all; between that time and 8 o'clock, only three or four more were seen, and observation was discontinued.

About half a dozen of the hundred were as bright as stars of the first magnitude; about fifty were of the second and third magnitudes; and of the remainder a considerable proportion were between the fifth and sixth magnitudes, just fairly visible to the naked eye, and only seen when one happened to be looking at the exact place where they appeared. Of course, it is likely that the real number of these faint meteors was much larger in proportion to the brighter ones than the actual observations would indicate. Several of the larger ones left trains which lasted for two or three seconds, never more, and were always red. In no case was the meteor, or its train, of the greenish or bluish tinge which characterizes the Leonids. The tracks were very few of them more than 10° or 15° long, and the motion was rather slow for a shooting star, the duration of flight being usually more than a second, even when the path was not more than 5° long. In a few cases the tracks were decidedly curved or crooked.

The 'radiant' was very well marked, — an oval region about 4° long, north and south, and about 2° wide. Its centre, according to the best estimate I could form, was about 2° north-west from Gamma Andromedae, A.R. $1^h\ 50^m$, δ 43°.5. The determination rests largely upon three nearly stationary meteors, with tracks not exceeding 15° in length, which appeared within the limits of the radiant; but it agrees satisfactorily with the result obtained by plotting fifteen or twenty other tracks in the same part of the sky.

It would seem from this that the radiant is now a little farther east than it was in 1872, when, according to A. S. Herschel (*Monthly notices*, vol. xxxiii. p. 78), its position was A.R. $1^h\ 41^m.6$ (25°.4) and δ 43°.7. In 1872 some of the best observers found evidences of two or more distinct radiants. Nothing of the

kind is indicated by any observations last night, though a few of the meteor tracks (perhaps five or six in all) would not pass strictly through the radiant if traced back. C. A. YOUNG.

Princeton, N.J., Nov. 28.

A bright meteor.

On Friday, Nov. 13, about 10.30 A.M., the attention of a number of our students was attracted by a brilliant meteor.

The appearance as described by Mr. H. Toulmin, of the senior class, is as follows: The path of the meteor began 15° or 20° west and north of the zenith, following a north-westerly direction, and ending some 20° from the horizon.

The brightness he compares to that of Venus when seen at night. The sun was shining brightly, and no clouds were noticed. No explosion was heard, nor did any fragments seem to reach the ground.

C. L. DOOLITTLE.

Lehigh university.

Absorption of mercurial vapor by soils.

Last year considerable attention was excited by the proposition to utilize the insecticide properties of mercurial vapor against the phylloxera or vine-louse. This suggestion originated with Mr. J. A. Bauer, a druggist of San Francisco, and himself the owner of a vineyard in the infested region of the Napa valley, where he had for some years experimented on the efficacy of mercury, and satisfied himself of its usefulness as a preventive of infection, when, in planting, each cutting was surrounded by a few inches of earth mixed with 'deadened' mercury. Upon publication of the fact, a considerable demand for the mercurial mixture (consisting of equal parts of finely divided mercury and clay or chalk) was made by persons interested, and many thousand vines were treated in different localities in the manner prescribed by Mr. Bauer. This was to mix thoroughly about a peck of earth with an ounce of the above mixture, and fill in with it the hole in which the cutting has been placed, to the depth of at least six inches from the surface. Many experiments were also made on vines already infested, to see if the mercury would gradually spread so as to disinfect the whole of the root system.

Contrary to expectation, most of these experiments proved a failure, inasmuch as the phylloxera seemed to continue, unchecked, on the roots already infested, and in some cases clean cuttings had become infested, despite the surrounding mercurialized soil.

Having witnessed a number of the successful experiments upon which Mr. Bauer's recommendations were based, I undertook an investigation of the circumstances of the reported failures, and soon discovered two that were essential. One was that the mercury used was considerably contaminated with lead, which is known to diminish exceedingly the evaporation of mercury; another, that oil had been used in order to facilitate the 'deadening' process, and thus each globule was covered with a film that additionally impeded volatilization. In fact, the iodine test for mercurial vapor showed that a mere trace of the latter existed around the mixture furnished by Mr. Bauer, while a similar one prepared with pure mercury showed abundant volatilization at the ordinary temperature, and acted very promptly upon insects.

Yet, upon using the latter mixture in the manner prescribed by Mr. Bauer, in a very clayey soil, neither the insects nor the iodine test manifested the presence of mercurial vapor. It was now remembered that Mr. Bauer's successful experiments had been made in a very sandy soil of the city of San Francisco; and the inference was plain, that, just as aqueous vapor would be absorbed to a much greater extent by a clay soil than by sand, so the mercurial vapor was at first absorbed by the former until saturation was reached, which might not be for many weeks or even months; the soil acting as an effectual disinfectant until supersaturated.

Experiments proved this surmise to be correct; and the investigation, still in progress, seems to show that the capacity of soils for the absorption of aqueous vapor may serve as an approximate measure of their relative capacity for the absorption of mercurial vapor also. Thus in pure sand, which in a saturated atmosphere at 15° C. absorbed only .5 per cent of aqueous vapor, the amount of mercurial vapor absorbed was too small for analytical determination; while in a clay soil, absorbing, under the same conditions, 6 per cent of watery vapor, the mercurial vapor retained at 49° C. amounted to .012 per cent, equivalent to about 130 grains per cubic foot of soil. Now, since from one-fourth to one-half cubic foot was used in the treatment of vines, it follows that from 33 to 65 grains of metal out of the 240 used in each case, would have to evaporate and impregnate the soil, before any free vapor would be available for action on the insects. At the low temperature of the soil this would naturally take a considerable length of time: hence the failures.

It is of course perfectly feasible to insure this impregnation beforehand by exposing the mercurialized soil to a higher temperature (e.g., to that of 49° C., easily attained in California by exposure to the sun) for ten or twelve hours, or for a much shorter time to steam-heat. A clay soil so prepared will act on the phylloxera as promptly as when sand is used; all being dead, or incurably poisoned, within from 20 to 30 hours.

The method is therefore far from being a failure, as has been industriously represented by interested parties. It will accomplish all that has ever been claimed for it; to wit, the preservation of young vineyards from infection through the ingress of the phylloxera from above; and, as there is no occasion for disturbing the earth immediately surrounding the stock of a vine, there is no reason why this protection should not continue for all the time the vine is likely to live. With proper precautions, it will also, no doubt, be available against other insect pests of similar habits; e.g., the 'woolly aphis' (Schizoneura lanicera Hausm.). The conditions for successful application in practice in various cases are still under investigation. E. W. HILGARD.

Agric. exper. station, Berkeley, Cal., Nov. 23.

The English sparrow.

Your correspondent in *Science*, No. 147, asks for information in regard to the English sparrows. In this city (Cincinnati) and vicinity there are large numbers of these birds, and local ornithologists have no hesitation in saying they drive away the native songsters.

At my house, in one of the thinly populated suburbs,

they were abundant during the summer. A patch of woods close by harbored many native birds which occasionally strayed into trees near the house. As soon as one of these ventured to alight on a branch, the sparrows would desert the eaves of the house and settle on the tree, and there they would chirp and chatter till the other bird was literally driven away. Robins and flickers were greatly annoyed, but the cat-bird flirted his tail in disdain, and seemed to be the only one which could not be driven away.

As for their insectivorous habits, I have been informed by Mr. Charles Dury that he has dissected forty or fifty of the birds which were shot at different times and places during two years. In none of these, with but a solitary exception, did he find a trace of the remains of an insect. Every one was filled with seeds of one sort or another; and he concluded the insect had been picked up and swallowed by mistake. Still, it would appear that numbers of cicadas were killed, though not eaten by the birds, here as well as in Washington.

As far as the extermination of the sparrow goes, it does not seem a difficult task. Let the laws protecting it be repealed. Let a bounty be offered for every scalp, and free permission to kill whenever and wherever found would tend to rapidly diminish the number of the pests. The increase in number is largely due to the protection afforded by law, and by the sentiment of people. If wolves, bears, and panthers can be exterminated by the means above spoken of, there seems little reason to say that the same result would not follow with the sparrow.

Jos. F. James.

Cincinnati, Nov. 27.

I would like to give some information in regard to the habits of the English sparrows, which I hope will soon be stamped as outlaws, and a price put on their heads, like unto those of all marauders.

They not only drive away our native birds, but are the worst enemies of the fruit-grower and gardener. They are not scavengers, but, on the contrary, by their habits become defilers of human dwellings and water. I will give such facts as came to my notice during many years of observation at my home in Hudson county, N.J., which will substantiate the above assertions.

We had provided numerous boxes for nests for bluebirds and wrens in the trees, and before the introduction of the English sparrows in New York, in 1864, these were invariably occupied by the same family each spring: additional nests were always soon occupied. Any one acquainted with these pretty little singers will understand the peculiar charm they lend to a country home. During the summer-time the grove would be full of thrushes, who would build their nests in the underbrush, and fill the morning and evening air with their melodious song.

Within four years after the introduction of English sparrows, they had found their way to our home, and immediately began harassing the bluebirds, sometimes destroying their nests. As soon as we noticed this, we took the part of our pets the bluebirds, and would fight the sparrows at every point. This was soon noticed by the bluebirds; and it actually happened, that, when hard pressed by the sparrows, they would fly close to the house, to attract our attention to their trouble by plaintive cries. We succeeded in protecting them for a few years; but, with the rapid increase of the sparrows, the bluebirds have left their former abodes, never to return to them except as travellers.

When we noticed that the wrens were harassed in a similar manner, we made the entrance holes to the boxes so small that sparrows could no longer enter. We then found that the sparrows would take turns about sitting on the perch in front of the opening until the old wrens had left, or until the young ones were starved. In two cases we found that old wrens had been kept imprisoned until starved to death by the sparrows preventing their exit. We did all we could to drive them off, — shot them with guns, caught them in traps, destroyed their nests, etc.; but all in vain. They learned to recognize a gun, and, as they always have guards in a flock, a signal from a guard would scatter them to the winds instantly. They could only be caught in traps for but a short time, when again they would become acquainted with them, and avoid them. The best way to drive them away seems to be to destroy their nests without tiring; then they will partly leave. They would fight the brown thrush, and scatter its eggs, whenever opportunity presented itself, and seemed to take particular delight in pulling the nests to pieces to build their own with the *debris*.

In spring they destroy the strawberries, to begin with, and attack every variety of fruit, except currants, gooseberries, and apples. They do not feed on cherries to make their living, like native birds, but merely take a bite of each berry, and destroy it wantonly. When pears are ripe, they will peck large holes in them to drink the juice. They generally appropriate half our vineyard, and cannot be frightened by scarecrows. They invariably keep themselves busy, when not hungry, by picking off young sprouts, especially of fine plants and rose-bushes, but do not spare trees. It seems that they do this merely to keep themselves busy. In addition to the above, they do not destroy worms which build a web, although they probably destroy chrysalides or open cocoons in winter-time, when they can find no other food. We have never seen them destroy worms in summer-time, when other food is abundant.

G. C. Henning.

Louisville, Ky., Nov. 27.

A new variable.

As an item of interest for your astronomical notes, I send the following: —

I have discovered the star D.M. +27,3890, to be a variable of the η Aquilae type.

A preliminary reduction of the observations so far obtained, from which a light curve has been formed, indicates strongly that the period will not vary much from four and a half days. The approximate limits of fluctuation I find to be from 5.6 to 6.7 mag. The position of the star for 1855.0 is R.A. $20^h\ 45^m\ 19^s.4$; decl. $+27°\ 42'.3$.

The star is likely to prove an interesting one, owing to its short period, there being only three known variables of this type with shorter periods.

The variability and character of the light changes have been confirmed by Mr. S. C. Chandler, jun., of the Harvard college observatory.

Edwin F. Sawyer.

Cambridgeport, Mass., Nov. 30.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Nov. 24. — Dr. George A. Koenig reported that he had examined the East Side railway cutting described last week by Mr. Aubrey H. Smith. He had determined, he said, a section agreeing quite closely with that described by Mr. Smith. The extent and succession of the several layers of sand and clay were noted in detail, together with the results of a partial lithological and chemical examination of the blue clay. In the latter a large number of diatoms, probably Pinularia viridis, had been found, thus increasing the probability that this portion of the cutting is of tertiary age. —— Professor Heilprin called attention to a fossil shell from the mouth of the Manatee River, Florida. It belongs to the genus Conorbis, which is restricted to the eocene and oligocene formations. No species of this genus heretofore known exceeds two and a half inches in longitudinal diameter, but the specimen now exhibited is six inches long. The other characters distinguishing it from its nearest ally are also well marked, and the specific name 'princeps' was proposed for it. The specimen was collected from the lowest point in Florida from which fossils have as yet been received, indicating the oligocene formation, which, however, probably extends to the extremity of the peninsula. —— A specimen of so-called coral rock from Eutaw Springs was exhibited to illustrate the fact that there was no trace of coral in it, the peculiar appearance on which the name is founded being probably due to the presence of Polyzoa. —— Attention was called to a specimen received from Miss Walters, illustrating a singular arrangement, in the form of a horn, of the particles of metal thrown off in sawing railroad irons. —— Dr. George H. Horn described a new form of beetle of special interest to entomologists. The specimen, which was collected in the Colorado desert by Mr. Wright, is two inches long, and therefore fully three times the size of its nearest ally. The species is a voracious wood-borer and entirely blind, being the largest species of blind beetle at present known. It belongs to the genus Dinapate, allied to Bostrychus, and differs from all known members of the family to which it belongs, in the possession of dentate tibiae. The specific name Wrightii was proposed for the form. —— Remarks on the peculiarities of the Florida coast, and on the distribution of geological formations on the peninsula, were made by Mr. Joseph Willcox and Professor Heilprin.

Royal meteorological society, London.

Nov. 18. — William Marriott read a paper on the helm-wind of Aug. 19, 1885. This wind is peculiar to the Cross Fell range, Cumberland, and is quite local, but very destructive. The chief features of the phenomenon are the following: On certain occasions, when the wind is from some easterly point, the helm suddenly forms. At first a heavy bank of cloud rests along the Cross Fell range, — at times reaching some distance down the western slopes, and at others hovering about the summit, — then, at a distance of one or two miles from the foot of the fell, there appears a roll of cloud suspended in mid-air, and parallel with the helm-cloud; this is the helm-'bar.' A cold wind rushes down the sides of the fell, and blows violently till it reaches a spot nearly underneath the helm-bar, where it suddenly ceases. The space between the helm-cloud and the bar is usually quite clear, blue sky being visible; at times, however, small portions of thin vaporous clouds are seen travelling from the helm-cloud to the bar. The bar does not appear to extend farther west than the river Eden. The author visited the district in August last, and was fortunate enough to witness a slight helm. He gives a detailed account of what he experienced, and also his observations on the temperature at the summit and base of Cross Fell, the direction and force of the wind, the movement of the clouds, etc. —— Mr. Henry Harries showed by means of daily charts that a typhoon, which originated near the Philippine Islands on Sept. 27, passed over Japan and the Aleutian Archipelago, entering the United States on Oct. 10. Crossing the Rocky Mountain range, it proceeded through the northern states and Canada to Labrador and Davis Strait. In the Atlantic it was joined on the 18th by another disturbance, which had come up from the Atlantic tropics, the junction of the two being followed by a cessation of progressive movement from the 19th to the 25th. During this period the severe gale which passed along our southern counties on the morning of the 24th was formed, its sudden arrival upsetting the meteorological office forecasts of the previous night. Observations are quoted, showing that it would have been impossible for the department to have been aware of its existence before about 3 A.M. of the 24th. Following in the wake of this storm, the parent cyclone reached the French coast on the 27th; its advent being marked, as in Japan and America, by violent gales and extensive floods in western and central Europe and Algeria. The village of Grindelwald was destroyed, and in the Austrian Tyrol the damage caused by floods reached at least two millions sterling. Passing through France and the Netherlands, the disturbance showed signs of exhaustion; and on Nov. 1, in the Baltic, it quietly dispersed after accomplishing a journey of over 16,000 miles in 36 days. This is the first storm which has been followed day by day from the Pacific to Europe. —— J. B. Jordan and F. Gaster explained the principle and working of Jordan's photographic sunshine-recorder. This instrument consists of a cylindrical dark chamber, on the inside of which is placed a prepared slip of photographic paper. The direct ray of sunlight, being admitted into this chamber by small apertures in the side, is received on the sensitized paper, and, travelling over it by reason of the earth's rotation, leaves a distinct trace of chemical action whenever the light is of sufficient intensity to show a definite shadow on a sun-dial. The cylinder is mounted on a stand with adjustments for latitude, etc. The record is fixed by simply immersing it in water for a few minutes. As this instrument records the actinic or chemical rays, it usually shows more sunshine than is obtained by the ordinary 'burning' sunshine-recorder.

Calendar of Societies.

Biological society, Washington.

Nov. 28. — Dr. Theobald Smith, A simple device for storing cover-glass preparations illustrative of bacterial disease; Dr. W. S. Barnard, Environmental digestion; Specimen mount, tube-holders, labels, and stoppers; Dr. C. Hart Merriam, The work of the U.S.

department of agriculture in economic ornithology; Mr. Charles D. Walcott, Evidence of the loss of vital force in certain trilobites on approaching extinction; Mr. Frederick True, A new study of the American pocket rats, genus Dipodomys.

Publications received at Editor's Office, Nov. 23–28.

Boas, F. Die Eskimos des Baffinlandes. Berlin, *Reimer*, 1885. 14 p. 8°.

—— Arctic exploration and its object. New York, *Pop. sc. monthly*, 1885. 8°.

Bolton, H. C. Index to the literature of uranium, 1789–85. (Smithson. rep. 1885.) Washington, *Government*, 1885. 36 p. 8°.

Chittenden, R. H., *ed.* Studies from the laboratory of physiological chemistry, Sheffield scientific school of Yale college, 1884–85. New Haven, *Tuttle, Morehouse, & Taylor, pr.*, 1885. 4+196 p. 8°.

Coulter, J. M. Manual of the botany (Phaenogamia and Pteridophyta) of the Rocky Mountain region, from New Mexico to the British boundary. New York, *Ivison, Blakeman, Taylor, & Co.*, 1885. 16+452 p. 12°.

Dawson, G. M. Boulder clays; on the microscopic structure of certain boulder clays and the organisms contained in them. Chicago, *John Morris co., pr.*, 1885. 9 p. 8°.

Forel, F. A. Les ravins sous-lacustres des fleuves glaciaires. Paris, *Acad. des sc.*, 1885. 3 p. 4°.

Johonnot, J., and **Bouton,** E. How we live: or, The human body, and how to take care of it. Revised by Henry D. Didama, M.D. New York, *Appleton*, 1886 [1885]. 178 p., illustr. 16°.

Nichols, W. R. Chemistry in the service of public health. An address before the section of chemistry of the American association for the advancement of science at Ann Arbor, August, 1885. (Proc. Amer. assoc. sc.) Salem, *Salem pr.*, 1885. 20 p. 8°.

Pickering, W. H. Colored media for the photographic dark room. Boston, *Amer. acad. arts and sc.*, 1885 [4] p. 8°.

Smithsonian institution. Price list of publications, July, 1885. Washington, *Government*, 1885. 27 p. 8°.

U. S. Tenth census — 1880. Vol. 13. Statistics and technology of the precious metals. Prepared under the direction of Clarence King, by S. F. Emmons and G. F. Becker. Washington, *Government*, 1885. 14+541 p. 4°.

Ward, L. F. Moral and material progress contrasted. (Trans. Anthropol. soc. Wash., 1885.) Washington, *Detweiler pr.*, 1885. [16] p. 8°.

—— Evolution in the vegetable kingdom. Philadelphia, *Amer. naturalist*, 1885. [17] p., illustr. 8°.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 4, 1885.

ELECTIVE STUDIES AT HARVARD.[1]

A NEW departure has been made in Harvard college during the past year, in that, for the first time in its history, freshmen have been allowed to choose a majority of their studies. Under the new rules but seven-sixteenths of the work of the freshman year will be prescribed: the rest of the college course, excepting a few exercises in English composition, will be elective.

Let us examine on what facts the Harvard faculty build their confidence in the elective system; in what sense it can be called a system; whether, furthermore, its introduction, while making instruction more agreeable, does not tend to lower its standard; and, last, whether its tendency is to foster character, and to make vigorous and law-revering men.

A preliminary objection is that the so-called system is really no system at all, but a mere cutting of straps. This is a misconception. The student under it merely chooses the specific topic of his study: what the amount of it shall be, and what its grade of excellence, are decided for him. After completing his freshman year, the Harvard student must pass successfully four elective courses in each of the following three years; and in each course or single line of study 50 per cent of a maximum mark are required each year for a pass. After his first year, then, the Harvard B.A. must have prosecuted twelve courses of self-selected studies, and mastered them at least half perfectly.

The essence, then, of the elective system, is fixed quantity and quality of study, but variable topic. Every important New England college admits it, to a certain extent, in both senior and junior years, while some allow it in the sophomore. In Harvard its adoption has been very gradual. In 1825 options were first allowed in modern languages. Years of experiment followed, with the result that the old method was step by step abandoned. The time of transition has been one of great prosperity. During the past fifteen years the gifts to the university have averaged $250,000 a year, and the number of students has steadily increased; the average attendance of undergraduates during the five-year period 1861 to 1865 amounting to only 423, while that during 1881 to 1885 reached a total of 873.

Harvard, then, has become prosperous by taking the lead in a great educational movement, the necessity for which lay in the fact that of late years the field of knowledge has so greatly widened. A place on the college curriculum has had to be found for modern languages, political economy, and science in its various departments. To avoid the danger of superficiality, — which is opposed to thorough-going discipline and the acquirement of sound mental habits of thought, — a choice was necessary between so many different subjects. In making this, too, personal aptitudes had to be considered, and thus a new principle was introduced; viz., that of valuing studies less according to their subject-matter than according to their fitness for the mind of the student. The will came to be treated as of primary importance. The student is told at Harvard, 'Study what you will, but you must will to study something.' The boy is thus taught how to choose during the formative period of his life, that is, between the ages of eighteen and twenty-two.

A manlier type of character is actually observed as the elective principle extends. The students show an enthusiasm for their work that was lacking formerly. Their ideal of a 'gentleman' is now higher than it was; and hazing, window-smashing, and disturbing a lecture-room, are now things of the past. That a decent scholarship has now become reputable, may be seen from the fact that in the last senior year 91 out of 191 men received 'honorable mention;' i.e., took a high rank in three or more courses of a single department. The following table, which gives the average percentage of marks attained at examinations during the past ten years shows that the standard of good scholarship has been steadily rising.

Year.	1874–75	1875–76	1876–77	1877–78	1878–79	1879–80	1880–81	1881–82	1882–83	1883–84
Freshman.....	59	55	5	56	62	62	65	67	64	63
Sophomore....	5	64	63	65	67	68	70	69	69	68
Junior.....	67	65	66	67	70	68	72	75	72	72
Senior.....	67	70	70	73	76	73	77	75	79	81

Observe that the marks become higher on approaching the senior years, where the elective principle most prevails, and that while, in 1874, one-half of the freshmen who were doomed to

[1] Abstract of Professor Palmer's article on Elective studies at Harvard university, *Andover review.*

prescribed studies gained less than 60 per cent, ten years later one-half of the seniors obtained four-fifths of a perfect mark in four electives.

Two objections may here be raised; viz., that the selected courses will have but little connection with each other, and that the easiest ones will always be the favorites. An answer to the first objection is contained in the fact that nearly one-half of the last senior class chose at least three closely related courses. The charge of 'soft' courses is the stock objection to the elective system, and seems, *a priori*, a sound one. The subjoined list of the courses which in 1883–84 were most largely attended by seniors and juniors, shows that, when choice gets full play, the factor of interest may make a severe study popular.

The courses were: Mill's political economy, 125 seniors and juniors; later European history, 102; history of ancient art, 80; comparative zoölogy, 58; political and constitutional history of the United States, 56; psychology, 52; geology, 47; constitutional government of England and the United States, 45. Are not these studies just those which should be the most popular?

It may be asked how such wise selections are secured, and we answer, simply by making them deliberate. In June the students must choose their studies for the next year, and notify the dean of their choice. Until Sept. 21, any elective may be changed, on notice sent to the dean. During the first ten days of the term no changes are allowed, but afterwards for a short time they are easily effected. For the remainder of the year no change is possible, except for urgent reasons.

By these means the faculty tries to avoid waste of time over unprofitable studies. Of course, not seldom unwise choices are made; but is not that true to an even greater extent in the case of prescribed studies? Moreover, the wastes of prescription affect chiefly the energetic and original students, while under the elective system it is especially the shiftless and dull who suffer, that is, men who cannot be much harmed by any system.

Then, how much the instruction under the two systems differs! When studies are prescribed, the teaching becomes often a secondary affair, and the pupils have to be urged to work. Under the elective system the student feels that he has something at stake, and a higher style of teaching becomes possible. Theses are read, and original works consulted. During 1860–61 only 56 per cent of the Harvard undergraduates consulted the college library; during 1883–84, 85 per cent.

Then, again, under the new system at Harvard, attendance at lectures is not compulsory; though, of course, a lengthened absence would not be permitted. The results obtained from trusting the students have been satisfactory. In the last senior class the total absences, whether from sickness, misdeeds, or other causes, amounted to but 16 per cent of the total number of recitations. Colleges requiring attendance seldom show better results.

But when studies are elective, professors are benefited equally with students. Teacher and taught are brought closer together, a common sympathy animating both alike. The professor, too, gets to see himself as others see him, and, if inefficient, his class soon dwindles away. Both professors and students are, in fact, put on their good behavior.

But why introduce the elective system so early as the freshman year? First, because the youth of eighteen needs just such a happy influence on his character as the system gives; second, because the loss of time incident to learning to choose can best be borne in the earlier, that is, least valuable, college years; while, last, the change from school to character methods is too important to be marked by the mere passage from one class to another. A change of residence should mark it. A character-college, then, while no place for the indolent rich, is best suited for the democratic many, to whom the elective system gives an opportunity for mental and moral expansion which no compulsory system can afford.

We must, however, remind the reader that the system is not yet perfected, and has still many imperfections. Convinced, as we are, of the soundness of its method, we invite criticism, which should now turn to the important work of bettering its details of operation.

ENSILAGE IN ENGLAND.

In a return to the house of commons, entitled 'Ensilage commission, evidence, part i., Preliminary report and minutes of evidence,' and in a 'Return of the replies to questions relating to silos and ensilage put by the agricultural department, privy council,' which have lately reached us, the latest information is contained in regard to the views held in Great Britain as to the value of silos and ensilage, and the practical successes and experiences with this still somewhat experimental method of preserving and feeding various kinds of green food to stock, in an undried condition.

The evidence obtained voluntarily by the parliamentary commission from thirty-eight witnesses, including Sir John B. Lawes, Viscount De Chezelles, and the owners and occupants of many large estates, their agents and tenants, and the inventors of different forms of silos, not excluding

any testimony of an unfavorable nature, but endeavoring to induce persons believed to be opposed to the system to give their opinion, has in their opinion, without exception, established the claims of the system to a considerable amount of success; and, although in some cases the results have been evidently more satisfactory than in others, nevertheless, all the systems seem to show that a nourishing, useful food for animals can be preserved, independently of any drying process, within wide lines of divergence in the details of the methods adopted. Different degrees of weighting and of exclusion of atmospheric air are the causes of different degrees of heat, and of consequent chemical change produced. It is apparently, as yet, largely a matter of opinion whether such chemical changes increase or diminish the feeding value of the ensilage, or its relative value in comparison to the green crop. The solution of this question the commissioners naturally regard as of great importance, and consider that careful feeding experiments, conducted with a view to test the exact effect of these changes, are very desirable. They find that whether the ensilage has been covered in immediately after cutting, or put in at intervals, the air not being immediately excluded and considerable heat developed, yet in both cases a useful feeding material has been obtained which would have been lost if any attempt had been made to convert it to hay in unfavorable weather.

As to the economy of different systems of making and storing ensilage, the commission is not prepared to express an opinion; nor does it desire at present to compare the advantages of different systems, the quality of the ensilage being not materially affected thereby. Special circumstances affecting particular localities must influence and regulate the methods employed. It was found that some of the best ensilage was produced with a pressure of not more than seventy pounds per square foot, but the degree to which weighting is necessary or desirable remains to be decided. Good results are claimed with weights between seven and three hundred pounds. Evidence shows that all differences in actual results, not dependent on composition of food-plants employed, are traceable to the variations in the degree to which fermentation is allowed to be set up in the silo, and the length of time it is continued. The fermentation, too, is controlled by or dependent on the manner of constructing, filling, covering, and weighting.

The testimony of the dairy farmers does not appear to justify the assertion, which has been more or less circulated, that dairy products are affected by ensilage; on the contrary, there is much valuable evidence to show that well-made ensilage distinctly improves the yield of milk and cream, and the quality of the butter. This is of interest on this side of the water, as a similar report has gained ground here, without, as far as has been learned from our investigations, any reason, unless the ensilage is fed too soon after coming from the silo. It should be exposed, at least in the case of sour maize ensilage, for a period of twenty-four hours to remove an odor which sometimes affects the milk when the feed is fresh. Tainting of the milk, the commission considers to have been due in many cases to proximity to strong-smelling ensilage after milking. The report concludes by saying that they have heard sufficient evidence to warrant the extension and development of the system as a valuable auxiliary to the farm.

The second part of the report of the commission, soon to appear, will contain the documentary evidence obtained in answer to twenty-five practical questions sent to the proprietors of silos in various parts of the kingdom. We have before us the answers to similar questions sent out by the agricultural department, privy council, which have been published in the second report which has been alluded to, in much the same way as was done by the U. S. department of agriculture two years ago. From the summary of the replies, we learn that the silos in Great Britain have doubled in number in the space of twelve months, that they vary in capacity from 96 to 55,440 cubic feet, averaging 2,801, and that they are built both with and without provision for drainage, but largely without. Drainage, it is suggested, requires care to prevent admission of air, and, we would add, loss of nutrients when the pressure is not properly regulated. The construction of the silos varies in material and location according to the locality where they are built. Any material furnishing the absolute requisite of rendering the walls air-tight seems suitable and successful, and localities where there is sufficient difference to enable the filling to be done at one level, and the drawing-out at a lower one, seem to be most favorable. Oats, green barley and wheat, maize, buckwheat, sanfoin, rye and all sorts of grasses, hop-vine, turnip tops, peas and beans, with mowings from hedges, and fences, and ditches, including nettles, sedges, and rushes, have all been more or less successfully made into palatable ensilage. The addition of salt was mentioned unfavorably in many reports, as was the case with the testimony before the parliamentary commission. The methods of compression have varied very much, but dead weight has been largely employed, and water-tanks so arranged as to be air-

tight covers have been successful in some cases. Opinion seems to be in favor of some simple method of lever pressure as economizing labor. Replies as to the influence of the weather, or temperature and moisture, show that success has been met with in both wet and dry weather, but that there should be no long exposure to the sun after being cut. Young crops make the best ensilage, and attention should therefore be paid to the condition of maturity. The temperature in various silos has been found to vary from no perceptible increase in heat to 150° F.; and according to the temperature at which fermentation goes on, sour or sweet ensilage is produced. A certain amount of exposure before closing the silo seems to have been most satisfactory. In some instances the silos have been opened and refilled as often as became expedient, the period extending over several weeks. At other times they have been filled and closed at once, with not entirely satisfactory results, as it has given a very sour ensilage, with strong odor, when the crop was put in wet; but in other cases the results from grass packed when perfectly wet have been altogether encouraging, even from mere earth-pits. As regards cost, it is stated that on the whole, as far as present experience enables one to form a judgment, the cost of making ensilage is less than that of making hay, more especially when wet weather prevails. Of 164 recorded opinions 72 make the cost of ensilage less than that of hay when it is made in fine weather, while 72 make it about equal, and 20 state that hay-making is cheaper. Deterioration from moulding was generally found for a few inches, but even when there was much deterioration, apparently, and the ensilage was sour and unpalatable, exposure for a few hours was all that was necessary to make stock eat it eagerly. Injury of this description is attributed to loose packing near the walls, and to leaks admitting air at doorways. Cases are rare where deterioration led to discouragement.

The results of feeding stock upon ensilage, especially dairy cows, and its effect on the quality and quantity of milk, the report states as follows:—

"It is often said to be preferred to all other fodder by dairy stock, as well as by horses, and to be less costly than the usual food. A marked increase in the quantity, and improvement in the quality, of milk and butter, appear generally, and accompany the change from dry fodder to ensilage as part of the regular food, and, when used with cake and meal, there is occasional mention of decided advance in condition. Cows appear, however, in a few instances, to have been fed entirely on ensilage for some months with good results, and it is added in numerous returns that more stock can be kept in winter upon land by the use of ensilage, while it is an excellent and economical substitute for roots.

"The recorded opinions of those who have tested its effects in regard to milk and butter assume the following proportions:—

	Milk.	Butter.
No change	22	1
Improved in quantity and quality	95	18
Decreased quantity and deteriorated quality	1	—
Increased quantity	93	13
Decreased quantity	5	2
Improved quality	34	26
Deteriorated quality	5	3
Improved quality and decreased quantity	4	—
Increased quantity and deteriorated quality	5	—
Favorable results (whether in quantity or quality not stated)	30	15
Unfavorable results (similarly not stated)	—	1
Total opinions	294	79

"Disagreeable smell and taste are occasionally referred to as having been present in both milk and butter, which often disappeared upon reduction of the quantity of ensilage given. With reference to this objection, it is recommended that, in feeding dairy cows with ensilage, much of it should not be near them during milking hours, and that persons so employed with it should wash their hands before milking. Ensilage is spoken of generally as a most wholesome and nutritious food for cows, and other stock are said to thrive upon it, especially when given in quantities of about half ensilage in combination with hay and other usual food. The superiority of sweet ensilage is often remarked upon, though a great many are in favor of the sour kind.

"Gain in weight is mentioned as having been tested, while loss of condition, and with cows, diminished quantity of milk, have been noticed after the ensilage made was all disposed of.

"There are but few statements which qualify the records in these respects, and further experience will doubtless do much to remedy the disappointment occasionally expressed in regard to first experiments."

As to the manner of feeding ensilage, the report shows that it is not often used exclusively, but combined with hay, meal, or other rich food, which gives better results. The quantity of ensilage has varied from seven pounds per day, to as much as the animals would eat. The average may be considered as from twenty-five to fifty pounds, according to the age of the animal, when other food is mixed with it. The combinations of food are most varied, and many interesting experiments are given, showing a larger yield of milk on an ensilage diet than on others of mixed materials. The almost unanimous testimony of the report is favorable as to the effect on the health of stock, while in some cases the praise of its value is unstinted.

The replies to the inquiry whether ensilage had been successfully made without a silo, seem to show that it has not frequently been done. Now and then it was made in stacks above ground, or in casks, but with much waste.

The conclusion expressed in the introduction to the report ends by affirming that, of the importance of ensilage as an auxiliary to other food for animals, whether for dairy, store, or young stock, among cattle as well as other kinds of stock,

there can now be scarcely any doubt, if the sum of the aggregate result of the replies recorded may be taken as a guide. The system hitherto may be said to have been somewhat tentative; but, if the rate of development shown in the past year continue, it appears probable that it will be far-reaching in its effect.

The system is undoubtedly peculiarly adapted to the moist climate of England; and the success there met with, in connection with past experience of a somewhat longer and wider range in this country, certainly points to a future which will make this method of feeding stock of the greatest value to the stock and dairy farmer. The evidence of the British farmer is of particular interest, in regard to a new system of this sort, as, from his habits of intensive farming, he is perhaps more qualified to judge of it than his American fellow-laborer.

THE PANAMA CANAL.

THERE is no engineering enterprise now in progress which has excited more general interest, or the successful completion of which will affect more deeply the concerns of the commercial nations of the world than the Panama canal. As work was begun in 1880, or perhaps more accurately in 1881, and as the completion of the undertaking was promised for 1888, it is quite time to inquire what progress has been made up to the present date, and what is the prospect for the future. The book of Mr. J. C. Rodrigues,[1] which is a reprint of a series of articles written for the London *Financial news*, gives a summary of the operations from the beginning until now, with his opinion of the condition of the company, the political bearing of enterprise as regards the United States, and the impending catastrophe. It deserves a careful perusal by every thoughtful citizen, and presents a more concise, and at the same time comprehensive statement of the case than has as yet appeared.

After a brief survey of preceding explorations of the isthmus, he gives an account of the expeditions of Commander Lucien Napoleon Bonaparte Wyse, of the French navy, and of the concession he obtained from the United States of Columbia, in 1878, for a canal at the Isthmus of Panama. In 1879 the 'International scientific congress,' as it was called, at Paris, under the auspices of M. Ferdinand de Lesseps, decided to recommend the construction of a ship canal at the Isthmus of Panama, to be built without locks and as an open cut from ocean to ocean. Those American delegates to the congress who were well fitted to judge of the facts from personal examinations, or reports of surveys at Darien, Tehuantepec, Panama, and Nicaragua, and other delegates qualified by practical experience, opposed in vain this decision, pointing out the difficulties and uncertain quantities which rendered a wise judgment and a reliable estimate impossible at that time, and urging the advantages of other sites. The enterprise, however, was to be carried on by Frenchmen; the assistance of M. de Lesseps was assured; and his success in carrying through the Suez canal, a far different undertaking in character of materials and obstacles to be overcome, was pointed to as an answer to all objections. The intention appeared to be to forestall any work which others might undertake at points which have been and still are regarded as much more favorable.

The canal congress estimated the cost of a sea-level canal at 700,000,000 francs, or £28,000,000, although a sub-committee had practically put the cost at 1,040,000,000 francs, and added that the "execution of such works, and principally that of such deep cuts, the stability of which is problematical, as well as the operations relating to the course of the river Chagres, constitute a complication of difficulties that it is impossible to estimate." There was added to the prime cost 25 per cent for unforeseen expenses, 5 per cent for expenses of banking and administration, and 3 per cent per year for interest during construction. An 'international commission' visited the isthmus in 1880, and reported that the canal would cost 843,000,000 francs, without preliminary, banking, and administrative expenses, and interest during construction, and estimating contingencies at but 10 per cent. They reported 75,000,000 cubic metres to be excavated, in place of 46,000,000 previously estimated. This estimate of cost M. de Lesseps first cut down to 658,000,000 francs, and later to 530,000,000 francs. A more extended acquaintance with the problem has raised the estimate of quantity to 125,000,000 cubic metres.

The dredging through the low alluvial lands near the sea, and the formation of harbor works, would, of course, present no difficulty; but the two rock-cuttings — the deepest at the Culebra, 820 feet in width at the top, containing from 25,000,000 to 30,000,000 cubic metres, of which but a small portion has yet been removed; and the Emperador cut, not so deep, but containing about the same quantity of rock — are very formidable obstacles, which will, at the rate work has as yet progressed, require many years to overcome. There is also the uncertainty whether little or much water will be encountered in the lower portions of these cuts. The removal of rock under water will swell the cost greatly.

[1] *The Panama canal: its history, its political aspects, and financial difficulties.* By J. C. RODRIGUES. New York, *Scribner*, 1885.

The Rio Grande and Rio Obispo cross the canal eleven and seventeen times respectively, and hence must be diverted, calling for thirty miles of new channels. The most formidable obstacle, however, and one which leads many engineers to doubt the possibility of the maintenance, if not the construction, of the canal, is the controlling of the tremendous floods of the upper Chagres, — a stream which, in the dry season, has a depth of but two feet, but which, in the rainy season, becomes a raging mountain torrent, rising sometimes in a few hours to a height of forty feet, and sweeping down immense quantities of *débris*. The projected line of the canal is first crossed by it at Gamboa, at an elevation of about fifty feet above the bottom of the canal; from Gamboa to the sea the canal is crossed by it twenty-nine times. It is evident that some most substantial and expensive works are needed to restrain or divert the flood waters of the Chagres, or the canal will be ruined by its irruption. An immense dam of masonry or earth, or of both materials, has been proposed, near Gamboa, a mile in length and from 150 to 200 feet high at its highest point, to impound and store up the flood in an artificial lake, from which it shall escape more gradually through sluices and channels provided for the purpose. The storage capacity of this reservoir is estimated at 6,000,000,000 cubic metres, which is not too much for a watershed on which a depth of five and one-half inches of rain has been known to fall in four and one-half hours. The occurrence of a second tropical rain, before the first has had time to drain away, might be disastrous. This difficult problem, which was pointed out and dwelt upon by some of the delegates to the congress, but was apparently passed lightly over by the majority, seems still to be unsolved at the hands of the French engineers, although the completion of its study has been promised from year to year.

The Panama railroad was purchased by the canal company; dwellings, hospitals, and workshops were erected; dredges, machinery, and tools were procured; and excavating was begun. Considerable earth and some rock have been removed. Rapid progress has been promised from time to time, but has not been attained; 2,000,000 cubic metres per month were hoped for, but 800,000 cubic metres have not been removed in any one month, and from 1881 up to May, 1885, the amount was only 12,376,000 cubic metres. The amount of material to be moved was first placed at 46,000,000 cubic metres, then 75,000,000 cubic metres, has now swelled to 125,000,000 cubic metres, and good judges believe this quantity to be much too low. M. de Lesseps has raised amounts as follows: 50 per cent on the shares of the company, 147,500,000 francs; loan of 1882, 125,000,000 francs; loan of 1883, 300,000,000 francs; and loan of 1884, 193,692,500 francs; making, in all, 766,192,500 francs. He has now applied to the French government for permission to issue new canal bonds to the amount of 600,000,000 francs, and proposes to call to his aid a lottery. A further call on the shareholders is also to be made. Discount and interest charges will amount to a formidable sum. One observer puts the time required to finish the canal at six years, another at twelve, and still others at twenty and even fifty years. Mr. Rodrigues fortifies his statements by citations from official documents, and from reports of U. S. officers and others, who have repeatedly inspected the progress of the work. He does not hesitate to predict the failure and bankruptcy of the present company within a short time.

The author devotes considerable space to the political aspects of the question, the stand which the United States has taken in the matter, the Monroe doctrine and the Clayton-Bulwer treaty, and the serious complications which may ensue if the French government shall take up officially the enterprise upon the failure of the canal company. The chapters given to the discussion of these topics are of great interest; but space will not allow a review of them here, even if it was appropriate for these pages.

HYPNOTISM.

PSYCHOLOGY is the last of the sciences to pass from the popular and literary stage to the technical. Time was when physics and chemistry were discovering facts of so flagrant and fundamental a nature, that fine ladies could be startled and entertained by accounts of them at dinner-parties. We have seen, in the last decade, biology present, in the Darwinian theory, what probably will be its last popularly interesting conception, and then plunge into such a labyrinth of embryological and other technicalities as only dry specialists can tread with her. Psychology even now trembles on the brink. Some departments are already quite intractable to literary handling; space perception, the measurements of various discriminations, and those of the time required by elementary mental processes, for example. But still much remains in psychology for the amateur of our generation to enjoy, and it is not yet impossible for treatises with some literary flavor to be written in that science. But the time is short; we seem on the verge of fundamental discoveries, and when they are made we must bid adieu to the simple charm, the easily verified facts. Work will be carried on

in a thicket in whose darkness only technically trained eyes will feel at home.

Hypnotism now stands where gravitation, galvanism, and the 'metamorphosis of plants' once stood. In France, especially, a real *fureur* of investigation is going on, and all sorts of people are trying their hand as magnetizers or as subjects. Repeatedly assailing the academies for recognition, as repeatedly rejected by reporting committees, whose criticism occupied itself too much with a few exceptional claims, and too little with the fundamental conditions of the hypnotic state, this latter at last wears official robes; and it is as 'bad form' now to be ignorant of its phenomena as a while ago it was to know any thing about them. To those who would no longer remain ignorant, Dr. Cullerre's little compilation[1] may cordially be recommended as the work of one who has tried to survey the whole ground, and who has certainly brought a great deal of scattered material together, and put it into readable shape. There is no other account of the subject at once so short and so complete. More than this we need not say of the book, for it makes no pretensions to originality, and the author's own critical comments are so rare, that a certain intellectual commonness about them may well be overlooked.

As matters now stand, the fundamental phenomena, sleep, narrowing of the field of consciousness, blotting out of memory, insensibility or hyperaesthesia, modifications of neuro-muscular irritability, hallucination in obedience to suggestion, etc., etc., are too *banals* to excite any longer much interest; and the attention of investigators is directed more and more to the *curiosities* of the hypnotic state, to those exceptional phenomena belonging to the individual subjects from which (by virtue of the law that nature shows us her secrets most readily in her monstrosities) most may be hoped for in the way of light thrown upon what is, after all, a great mystery.

Foremost among these novelties are the 'post-hypnotic impulsions,' which may take place weeks, or even months, after the patient has been hypnotized, in obedience to suggestions made during the trance; of which suggestions themselves nothing is remembered, the patient usually assigning for the act he finds himself irresistibly driven to perform, some pretext trumped up at the moment. It is obvious what power this gives to any unscrupulous operator who might wish to use his subjects as cat's-paws to crime. The remedy on the subject's part, if once he mistrusts the operator, would seem to be to get himself hypnotized by some other person, who, by suggesting that the former operator's proceedings should thenceforward be ineffectual, would in many cases actually render them so.

These inhibitions of certain processes by *negative suggestion* are among the greatest curiosities of hypnotism, and bid fair to put us on the track of important psychological secrets by isolating phenomena which usually are found combined. We may make a patient blind or deaf to special objects, and to nothing else, just as we may make him blind of one eye, deaf of one ear, or insensible to pain in one part of the body, — all by verbal suggestion that he shall become so. And the distinction that psychology makes between the mere *sensation* we receive from a thing, and the mental apperception or assimilation of the latter, so as to form a *percept*, is beautifully brought out in these experiments. For it seems that in them the blindness or other peculiarity is not the lack of sensation. A patient, for example, made to look at a red wafer on a sheet of paper, but told that there is nothing there, will not see the wafer — will say that the entire field of view is white. As soon, however, as the wafer is blown away, he will say he sees a green spot, its negative after-image. So a patient made blind to a particular by-stander cannot be made to see *him*. But how can the patient know *which one* to be blind to, without in some way discerning him? Some sort of a sensation of him must be there, or he would not be so singled out for invisibility.

The 'hemi-hypnotic' phenomena again afford a sort of moral vivisection of the patient into two halves. One side of the body may be cataleptic or lethargic, the other awake. One side of the face may be made to laugh, the other to weep. "If, in the hands of an open-eyed cataleptic subject, her knitting-work is placed, she takes it, and works away with remarkable skill. If the operator then close one of her eyes, the hand on the corresponding side falls inert, and the other hand continues all alone to perform the knitting movements, which, of course, then produce no effect." M. Richer describes a similar transformation of the act of washing the hands, into a unilateral operation. MM. Binet and Féré in some papers in the *Revue philosophique*, too late apparently to be noticed in Dr. Cullerre's book, have described most wonderful transferrences of the unilateral phenomena from one side to the other of the patient, whenever a magnet was brought near her, even without her knowledge. Many parts of their account are so startling that more verification is highly to be desired.

[1] *Magnétisme et hypnotisme.* Exposé des phenomènes observés pendant le sommeil nerveux provoqué. Par le Dr. A. CULLERRE. Paris, *Baillière*, 1886 [1885]. 16°.

Still more startling things are reported by MM. Bourreau and Burot of Rochefort, being nothing less than 'stigmatization' by suggestion, in a certain patient, i.e., the bleeding of spots of the skin at word of command. They have also seen, and convinced others, that this patient and one other, were influenced by medicines *in closed vials held near them*, salivated and sweated by Jaborandi, vomited by ipecac, purged by scammony, put to sleep by opium, etc. In these experiments the subjects were not hypnotized. They remind one of observations published long ago by Dr. J. R. Buchanan, and republished last year in his work, 'Psychometry.' Thus miracles expelled by 'scientific good sense' clamor again for admission. In particular the limits of suggestion have not to be re-tested. The new results seem to point towards some effects that may be direct and physical, and not due to suggestion or expectation. We are as yet but on the threshold of the subject.

If one wishes to see what hopes for success the method may inspire, one should read the brilliant article of Mr. F. W. H. Myers, entitled 'The human personality,' in the *Fortnightly review* for November. As Mr. Myers there says, we hold the wand of Hermes, which we have not learned to wield.

S. E.

THE UTILIZATION OF BY-PRODUCTS IN CHARCOAL-BURNING.

In many processes for the conversion of crude materials there is much waste, which is likely to be remedied only when such materials become scarcer, and hence more costly. In producing charcoal for use in the iron manufacture, the wood is commonly burned simply for the sake of the charcoal itself; and brick, dome-shaped ovens are used, from which the smoke and other products driven off by the process of slow combustion pass freely into the air. But in some cases such of the products as are commercially valuable are saved, with results that render it surprising that more care is not usually taken to retrieve what is so often lost. The success which has been met with at Elk Rapids, Michigan, in saving and profitably utilizing the by-products of charcoal-burning, is worthy of imitation.

At this place is a blast-furnace, turning out some seventy tons of charcoal-iron daily, and consuming the charcoal from one hundred and twenty-five cords of wood, previously carbonized in thirty-five kilns. The smoke and vapors given off in the latter process are drawn — by means of two exhaust-fans three feet in diameter, and making twelve hundred revolutions per minute — through the bottom of the kilns, and thence through a long wooden pipe forty-two inches in diameter, to the chemical works. Here the vapors are distributed to ten condensers, each containing seventy-five copper tubes two and a fourth inches in diameter, through which cold water is passed. So much of the vapor as is condensed is then drawn off into a large settling-tank: the uncondensed part is forced under the boilers by steam-injectors and burned, thus helping to furnish the motive power required at the works. In the tank the larger part of the tar settles to the bottom. This tar is now mixed with sawdust, and burned under the boilers; although formerly, when more in demand, it was drawn off and barrelled for market.

The remaining liquor is pumped to a second tank, and neutralized with lime. After the impurities have had time to settle, it is conveyed to a still, where the wood alcohol is distilled from the acetate of lime just produced. The liquor of acetate of lime is next evaporated by steam-heat nearly to the granulating point, then conveyed to grainers, and, by the further application of steam, it is obtained in the solid state. Finally it is shovelled out, drained, dried in pans, and put up in bags as the acetate of lime of commerce. The capacity of the works is 10,000 pounds of acetate of lime per day.

The alcohol, on issuing from the still, has a strength of eight per cent; but further distillation brings it to eighty-five per cent, when it is barrelled for shipment. It is, however, again refined by other parties to ninety-five per cent alcohol, and used for various mechanical purposes. The daily production can reach one hundred and seventy gallons.

An experiment has recently been tried at the London inventions exhibition aquarium, by Mr. W. August Carter, with a view to discovering how far fish are prone to sleep. After close examination, he found that among fresh-water fish the roach, dace, gudgeon, carp, tench, minnow, and catfish sleep periodically in common with terrestrial animals. The same instincts were found to actuate marine fish, of which the following were observed to be equally influenced by somnolence; viz., the wrasse, conger eel, dory, dogfish, wrasse bass, and all species of flat fish. Mr. Carter states, that, so far as he can discover, the goldfish, pike, and angler-fish never sleep, but rest periodically. Desire for sleep among fish varies according to meteorological conditions. Fish do not necessarily select night-time for repose.